– El respeto a la jerarquía funcional: lo que hace que una solución destinada a una agrupación de pocas personas sea distinta a la que debe servir a un gran número de habitantes.

– La aplicación de muchas escalas para muchos dueños: de tal modo que, pensadas básicamente para el hombre, que es el receptor último de la prestación, contemplen al mismo tiempo la necesaria presencia de otros elementos que, como los automóviles o las máquinas en general, están para servirlo.

Considerando como causas principales de los problemas:

– El crecimiento demográfico exagerado.

– El desarrollo económico descontrolado.

– Los cambios sociales que tienden a distribuir más bienes a más personas.

– La urbanización como consecuencia de lo anterior.

– El progreso tecnológico, que ha introducido la máquina y la cibernética en la vida del hombre.

Este conjunto de factores origina para la ekística dos grupos de problemas:

– Los que inciden sobre áreas sobredesarrolladas, en las que, por tratarse de zonas de vanguardia, se carece de datos para enfrentarse con experiencia a los nuevos problemas.

– Los que inciden sobre áreas subdesarrolladas, que pueden considerarse zonas de urgencia, pero que permiten actuar por comparación y beneficiarse de los aciertos y errores experimentados previamente en otras zonas.

Con todas estas referencias, creo que es necesario concluir que, en mi opinión, deben evitarse las reacciones esporádicas y bruscas que puedan conducir a desastres, actuando con energía pero sin nerviosismos, intentando alcanzar acuerdos generales sobre las metas que hay que lograr, clasificándolas y priorizándolas y asumiendo que las decisiones en este sentido corresponden a la comunidad y no al experto, aunque sea éste el encargado de presentar con objetividad las ventajas e inconvenientes que reportan las distintas acciones posibles. Recordamos, por último, que cuando afirmamos sólo nos aproximamos a la realidad, y que cuando actuamos interferimos.

Ecology. Ecologism and ekistics

Ecology, as a part of the biology that studies the interrelations of living beings among themselves and with their medium, has now been considered to be a more or less autonomous science for about a century, although as a question of conscience it made itself especially well known with the International Biological Programme from 1964 to 1974.

At the same time its shifts towards the «ecologist» movements are considered to have begun formally at the United Nations Conference held in June 1972 in Stockholm, even though there had already appeared «idealogical» tendencies based on some of the concepts of scientific «ecology» (Greenpeace was founded by six members of different nationalities in 1970).

We should therefore take care when we come to interpret the adjective «ecological», nowadays used so widely and so frequently, since it can be considered either to come from the word «ecology» and thus be impregnated with the scientific character embedded in this, or to be an improper derivation from «ecologism» and so be tinged with the whole ideology which is manifest in this term (although what would be correct in this case would be to use the adjective «ecologistic»).

We should make it a condition to reserve the term «science» exclusively for the certain knowledge of things through their principles and causes, as well as for the corpus of methodically ordered doctrine which constitutes the branches of human knowledge. We should, on the other hand, apply the term «ideology» for those systems of ideas which form groups of concepts, beliefs and ideals in the factual and normative field and which serve to explain social phenomena and thus direct and simplify the socio-political options open to the individual and the community. All this without going to the extreme, as does marxism, of regarding «ideologies» as systems of malformed and confusing ideas with which the ruling class tries to justify its position in contrast to «scientific theory».

In any case, what is clear is that humanity is interested in «ecology» even though in an incomplete way and by using arguments drawn from it, with which it recommends a diversity of attitudes and movements,

scientific and ideological, which could, however, be equally well supported from other fields of human knowledge.

When Adam Smith, in 1784, said in *The Wealth of Nations* that «consumption is the only aim and purpose of all production and the interest of the product must be taken into account only insomuch as it is necessary to favour that of the consumer» he was already in the eighteenth century warning of the risk of uncontrolled production, and especially when he added: «but in the mercantile system the interest of the consumer is sacrificed in an almost constant way to the interest of the producer: and production rather than consumption seems to be considered the ultimate end and object of all industry and commerce» (chapter VIII of book IV).

Likewise during the nineteenth century, and from a different field, the ousting of the «mechanistic» model by the «thermodynamic» was again a warning of the need to change the mechanical vision of the Universe, with its perpetual movements of impeccable, measured and balanced order, and to replace it with the new thermodynamic vision with its irreversible movements, where order mingles with disorder, with waste and imbalance and so brings to a crisis the principles of simplicity, utility and economy defended by classical rationality.

Although it is accepted that the importance of any scientific theory is a function of the simplicity of its premises, of the difference in the types of subjects it relates to and of the scope of its application, it turns out that scientific paradigms reveal extraordinary inertia and resistance to change and are only abandoned when they give rise to great interpretive or predictive failures which justify the popular saying that «desperate ills call for desperate measures».

In the nineteen-seventies there began to become known a series of phenomena which seem to have gone on accumulating up to the present day and which could be included in this concept of «desperate ills» which demand «desperate measures», since they are interpreted as uncontrolled errors, either because of the unforeseen elements in them or because they have gone beyond admissible levels.

Contamination, the greenhouse effect, the threats of CFCs, the reduction in the ozone layer, acid rain, the running down of the planet's resources, the risks of nuclear energy, urban concentration, the reduction of animal and vegetable life, the worship of the body and health, the invasion of the motorcar, pest killers... all these are problems which can be listed as some of those failures which press negatively on the scales of the achievements of human civilization but through the simple fact of being known and accepted have begun to lose weight.

The evolution of the world's conscience in recent years has facilitated the acceptance of many scientific paradigms which, although known of, had not yet managed to be incorporated into political decisions. This change of attitude may perhaps be attributed to the fact that the problems now no longer refer to «others» but have begun to affect «everybody», thereby obliging us to act with a «home-bound egoism» that is much more effective than the «distant altruism» into which they were channelled in the past.

Everything began with the rise in the price of oil and the unleashing of a chain of exaggerated catastrophic prophesies which allowed the development of hasty austerity campaigns of minimal technical validity but which psychologically predisposed citizens to assume a conscious fear of the exhaustion of energetic resources in particular and of the whole of the planet's resources in general.

The development of new alternative sources of energy as a way out of the oil crisis was surprisingly accompanied by organized campaigns against nuclear energy, based on the reasonable exploitation of the fear of radioactive leaks and on the widespread publicity given to the most minor incidents detected in any of the atomic power stations constructed for the production of electricity.

The sequence of reports on nuclear accidents reached its peak on 29 April 1986 with the revelation of the catastrophe at the Chernobyl nuclear plant situated 30 km from Kiev in the heart of the Soviet block, falsely considered by certain green movements as a paradigm of «ecologism». These campaigns were successful and in some countries (including our own) managed to paralyse the expansion of nuclear energy, without, however, offering any alternative solution of similar efficiency.

The decrease detected in the ozone layer gave rise in 1980 to a EU agreement, whereby the production capacity of CFCs (chlorofluorocarbons) was blocked, and in 1985 twenty-five countries signed the Vienna Convention for the protection of the ozone layer. Finally, in September 1987, the Montreal Protocol, which limited the production and utilization of CFCs

was approved. Later, in 1989, the EU decided that by the year 2000 all production and use of CFCs should cease. Latest investigations on the thickness of the ozone layer led the signatory states of the Montreal Protocol to revise it in November 1992 and accelerate the reduction in CFCs, establishing the suppression of production and consumption of halogens as from 1 January 1994.

And among these wide-reaching campaigns many others were being created, aimed at combatting the disposal of radioactive waste in the sea, the capture of whales, the culling of baby seals, the contamination of the Mediterranean, the destruction of the Amazon regions....

In short, a new mechanism for supranational sensitization and pressure had been discovered, which some used for concrete, precise ends and others as a political ideology, organized within the green parties or even in order to present it as a model for the struggle against capitalism, incorporating the alternative programmes into the communist manifestos that were undergoing a process of reorientation after the fall of the Soviet block.

However, history also offers us examples of collective attitudes mistakenly directed by false visions of the future which found their expression in irrational and regressive positions. Thus, for example, during the course of the first millennium of our era, faced with the supposedly imminent arrival of the end of the world, people abandoned the fields and their work in villages to do penance and prepare for the Last Judgment. And during the Industrial Revolution workers who had been replaced by the new machines organized destructive acts against these machines since they considered them directly responsible for their misfortune.

But the fact is that in general it has been more beneficial for humanity to tackle great failures with great solutions for the future than to regress to the conditions that prevailed before the failure. Nevertheless, this attitude must not be wrongly interpreted as an unmovable axiom since some reasonable doubt must always persist concerning any principle.

Because of all this, the questions which, in this context, I consider we should raise are: Are we in a position to be able to use any of the knowledge which ecology affords us about the way in which the living layer of our planet functions? Will such knowledge enable us to improve our destiny?

Let us look at some of the principles which ecology explains for us:

– From a philosophical point of view, the affirmation of our isolation in the Universe should serve to increase the sense of unity and solidarity among the inhabitants of the planet.

– Many of the present characteristics of the Earth have been achieved little by little and, in part, by the action of primitive organisms.

– In spite of everything, changes have been relatively few, and conditions favourable to life have been maintained for a long period.

– The Earth possesses certain mechanisms of self-regulation, which maintain the temperature at a steady level.

– The great variety of fluid cover and the diversity of zones on the surface of the Earth offer an extensive range of conditions of life.

– Life is characterized by a constant flow of materials and a continuous rebuilding of structures, which requires energy of a high quality (such as light or chemical bonds) to carry out work.

– The same quantity of energy cannot be used in the same way twice consecutively because it loses quality (light has a higher quality than heat).

– For life, only about 0.2% of the energy which reaches the Earth is used directly, while about 25% is used in evaporating water and causing rain, thus indirectly influencing vegetable life.

– Life has not evolved in order to work hard but, by means of its structures, in order to occupy the whole Earth with a minimal energy investment.

– The component (chemical material) which is most scarce or slowest to be supplied determines the speed of production of the complex compounds which form the basis of a living structure.

– One thing is production and another biomass (accumulated mass which produces). Production / interest = biomass / capital. If we destroy biomass to produce more in a short period, we shall lose productivity in the long term.

– Exploitation entails the simplification of the original ecosystems.

– Life is characterized by a continuous transport of materials from outside to inside and from inside to outside.

– From the beginning life has acquired the form of discontinuous units with separate individuals belong-

ing to a large number of species, with inequality of functions.

– On the Earth there is between eight and ten times more dead organic matter than living (not counting the highly transformed matter that is the origin of oils and carbons). Life leaves behind it an immense mass of contamination that has not been invented by man.

– The chains (trophic network) have no more than five steps (unless one takes into consideration the parasites of the large animals). And animals which are higher in the trophic hierarchy are usually characterized by a larger size, a longer life and a smaller rate of renovation, which leads us to represent ecosystems as a group of growing cogwheels which turn increasingly slowly at the same time as they rise in level.

– There exist hundreds of thousands of species but only a few serve as food for man. It seems that for a system to be exploitable it must be simplified.

– Nature left to itself gives the impression of investing in «works of art», as the varieties of species can be considered to be, while man tends towards monoculture and towards provoking the extinction of species.

– Nature presents two complementary aspects:

  – Richness: with the marvels of each one of the species.

  – Harmony of the group: where the detail is submerged in the grand symphony of the system.

– Ecology leans towards the harmonic contemplation of the group but cannot forget the detail.

– In any group of organisms there exist a variety of roles and fantastic adaptation.

– The constitution of a new ecosystem entails a selection of the fittest.

– The strategies for adapting to the environment are:

  – Strategy of the R: organisms with a high mortality rate multiply rapidly.

  – Strategy of the K: organisms with a relatively longer life span which produce few offspring but which protect them when they are young from their enemies (which are few) renew their populations more parsimoniously. As a consequence, these take greater advantage of the acquired knowledge which they accumulate through experience and not through genetics.

  – Some organisms adapt through camouflage, but others adopt high contrast cautionary colours (aposematic) which give warning of their toxicity, while others, inoffensive, copy the dress of the former to elicit respect.

Ecology makes us see man as a being basically tied to nature but at the same time as a manipulator of external energy (light, heat, agriculture, industry and transport). The challenge rests in balancing the manipulation with a harmonious interrelation of the whole of nature.

In this sense, extrapolations from the principles of biology to the study of problems generated by the development of human communities has important and influential antecedents in the field of town planning.

The Scottish biologist and sociologist Patrick Geddes (1854-1932), the author of works such as *City Development* (1904) and *Cities in Evolution* (1913), forms a part, alongside Ruskin, Howard, Mumford and others, of the trend of thinking which initiates the preaching of the end of the metropolises, which will be replaced by scattered settlements spread over a vast area.

The conflict between country and town is a living polemic that has undergone many attempts at resolution by means of drastic reductions in density of occupation, which have given rise to a type of urban planning, with landscapes of barely finished surroundings and even with a certain sensation of emptiness, that has been baptized with the name *subtopia* (the paternity of the term is attributed to the journal *Architectural Review*). Repugnance towards the large town provoked the defence of formulas for «self-sufficient districts» where partial or simple solutions led to the loss of the real essence of the problem and left the relationship between integration and autonomy unresolved.

Thinking of this idea of complexity which any act entails and keeping within my particular speciality as an architect, I have meditated on the connection which ecology has with ekistics, understood as the science of human settlements, whose creator and inventor of the term, the Greek architect-engineer Constantino A. Doxiadis, has applied to such diverse areas as rural settlements, agriculture and irrigation, industrial settlements, power stations, public works, commerce, tourism, communications, dwellings, urban renovation and the development of new towns.

Possibly the chief merit of ekistics resides in its ability to create a science-supported corpus of doctrine with which to tackle the analysis of and solution for human settlements, using criteria and methods which are within the framework of what could be considered «sciences of the environment».

Ekistics, born in 1941 with the aim of becoming the science of human settlements, shows us that those elements which intervene in the birth and dynamic growth of urban areas are:

- Nature: on which they are settled.
- Man: for whom they are created.
- Society: which shapes and conforms to urban settlements.
- Networks: which constitute the circulatory system through which materials and energy are moved.
- Constructions: in which the functions are housed and developed.

Ekistics proposes a method of work based on:

- Starting from a determined location, taking into consideration the natural and socio-cultural factors related to the site.
- Being aware of past achievements and mistakes in order to learn from experience.
- Critically evaluating any incorporation of alien ideas and applying them with caution.
- Synthesizing local features with universal criteria while seeking the difficult balance between special forces and general trends.
- Bearing in mind that any solution must be resolved in four dimensions, that is to say, in the variables of space (length, height and breadth) and that of time.

It lays down certain aims directed at achieving:

- Human happiness through the satisfaction of needs and desires.
- The maintenance of a unity of objectives in economic, social, political, administrative, technical and aesthetic aspects. This urge to view as a whole all the goals to be achieved makes ekistics consider a solution to be incorrect when, even though it may be aesthetic, it is, for example, wasteful of energy or contaminating.
- Respect for the functional hierarchy, which means that a solution earmarked for a small group of persons is different from the solution that must serve for a large number of inhabitants.
- The application of many scales for many masters, so that, although basically established for man, the ultimate recipient of what is offered, they contemplate at the same time the necessary presence of other elements which, like cars or machines in general, are there to serve him.

It considers the principal causes of the problems to be:

- Exaggerated demographic growth.
- Uncontrolled economic development.
- Social changes which tend to distribute more goods to more persons.
- Urban development resulting from the foregoing.
- Technological progress which has introduced the machine and cybernetics into the life of man.

For ekistics this group of factors gives rise to two groups of problems:

- Those that affect overdeveloped areas where, as they are vanguard zones, there is a lack of data that can be used to tackle the new problems with experience.
- Those that affect underdeveloped areas which can be considered to be urgency zones but which allow action to be taken through comparison and by taking advantage of previous achievements and mistakes in other zones.

From all the above I feel it necessary to conclude that in my opinion we must avoid sporadic, sudden reactions that can lead to disaster; we must act with energy but with patience and attempt to achieve general consensus about the objectives to be attained, classifying them and establishing priorities and accepting that such decisions correspond to the community and not to the expert, although this latter should be the person responsible for an objective presentation of the advantages and disadvantages of the different actions that are possible. And we should remember that when we make a statement we are only approaching reality but when we act we are interfering in it.